Floodplain Inundation Characteristics

Expectation:	Stage hydrographs that result in floodplain inundation depths and durations comparable to pre-channelization hydro-patterns.
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Relevant Endpoints:	Impact Assessment - Flood Control Restoration - Physical Integrity - Hydrology Restoration - System Functional Integrity - Habitat Quality Restoration - System Functional Integrity - Persistence Restoration - System Functional Integrity - River/Floodplain Interactions

Baseline Conditions: Baseline conditions were derived from daily stage at: 1) Fort Kissimmee in Pool B (June 1985 - May 1999); 2) headwater at S65C and S65D; 3) C38BAS in Pool D; 4) tailwater at S65B (June 1996 - May 1999); 5) PC33 on Micco Bluff Run in Pool C; and 6) 18 (15 floodplain and 3 river) additional monitoring sites in Pool C. S65C is located near the middle of the area to be restored and is the downstream control for the first phase of restoration. Data at PC33 and the additional 18 gauges in Pool C are representative of existing conditions (November 1997 through May 1999) within the area that will be affected by the first Phase of restoration. Data at C38BAS are representative of existing conditions (October 1997 through May 1999) within the area that will be affected by the third Phase of restoration. Headwater levels at S65C (Pool C) and S65D (Pool D) are representative of existing water levels throughout Pool C and D (June 1971 - May 1999) and were included due to the limited amount of data at PC33 and BASC38.

The natural-sloping water surface of the historic river was replaced by five pools (A, B, C, D, & E), which step down water levels in six feet increments. Stages in Pools C and D (Figures 1 and 2) are maintained at constant elevations with little fluctuation within or between years. The flat-water surface within each pool has drained 2/3 of the floodplain in the upper portion of each pool and permanently inundated the southern area (Toth, 1993). Based on data at all stage gauges in Pool C, less than 1/3 of the floodplain was wet 92 percent of the period between June 1996 - May 1999. Annual hydroperiods in this area ranged between 181 - 366 days per year and depths were typically α 0.25 feet.

Since 1984, water levels at Fort Kissimmee and throughout Pool B have been influenced by seasonal stage fluctuations and Demonstration Project weirs. Baseline data at Fort Kissimmee (Figure 3) indicate that mean-daily stages ranged between 39.5 - 42.5 feet, inundating 40 - 50 percent of the adjacent floodplain 2 months per year. Management of water levels in Pool B has increased inundation, however mean stages remain three feet below historic levels (Figure 4).

Reference Conditions: Reference conditions were derived from daily stage data at Fort Kissimmee, Fort Bassinger and PC33 (estimated) from June 1942 - May 1959. Stage at PC33 was estimated by linear interpolation of stages at Fort Kissimmee and Fort Bassinger and is representative of reference conditions for the lower portion of Pool C. Shapes of historic annual mean-stage duration curves at these sites (Figures 4,5,6) are similar and show that average stages fluctuated approximately three feet annually. Mean stages at Fort Kissimmee ranged from 43.0 - 45.5 feet per year and inundated 77 - 100 percent of the adjacent floodplain. Fort Bassinger mean-stages ranged between 28.0 - 31.5 feet annually and inundated 15 - 85 percent of the adjacent floodplain. Based on the estimated data for PC33, mean stages ranged from 33.5 - 36.5 feet per year and inundated 20 - 95 percent of the floodplain.

At Fort Kissimmee (Figure 7) seventy-seven percent of the floodplain was inundated an average of 257 days per year and water depths ranged between 1 - 3 feet an average of 147 days per year. Thirty-six percent of the floodplain adjacent to Fort Bassinger (Figure 8) had a mean hydroperiod of 251 days and forty-three percent of the floodplain at PC33 (Figure 9) was wet for an average of 243 days per year.

Mechanism for Achieving Expectation:	New regulation schedule and operation rules were developed to modify headwater inflows so as to reflect climatic inputs to the upper basin and provide a more natural flow regime to the lower Kissimmee River basin. In addition, regulation schedules and operation rules for the S65D and S65C structures will be modified based on historic stage discharge relationships for these locations.
	Restoration of the physical form of the river, through backfilling C38 and carving new river segments, will direct flows through the Kissimmee River and lead to the movement of water onto the floodplain. Slow drainage of water off the floodplain (stage recession rates) also will facilitate reestablishment of floodplain inundation characteristics.
Adjustments for External Constraints:	The expectation does not account for climatic conditions, which may impact delivery of flows from the headwater basin during dry periods. Lack of flow may cause greater portions of the floodplain to be dry for longer periods.
Means of Evaluation:	Daily stage data from a network of surface water gauges throughout the restoration project area will be used to calculate annual hydroperiods for the floodplain. Gauges include the historic locations of Fort Kissimmee and Fort Bassinger gauges and 20 surface water sites (15 floodplain, 4 river, and S65C headwater) in Pool C.
	Floodplain inundation depths and durations within the restoration project area will be compared with historic data. Interim evaluations will begin in Pool C with the first year of data after implementation of new regulation schedules. Annual stage duration curves for PC33 will be plotted with estimated historical curves and should range between the 90th - 10th percentiles for this site (Figure 6). The annual number of days that varying portions of the floodplain are inundated at different depths will be calculated for all of Pool C (all gauges in Pool C) and at site PC33. Results will be compared with estimated historic data from PC33 (Figure 7).
	Statistical analyses also will be conducted to detect differences in mean daily stages and annual hydroperiods at Fort Kissimmee and Fort Bassinger. Restoration efforts near Fort Bassinger and Fort Kissimmee are part of the third and fourth phase of the overall restoration program. Statistical comparisons will begin after a minimum of 10 years of post-restoration data is collected.
Time Course:	Historic floodplain inundation characteristics will be initiated with the implementation of new regulation schedules, backfilling of C38, and recarving of new river sections.

References:

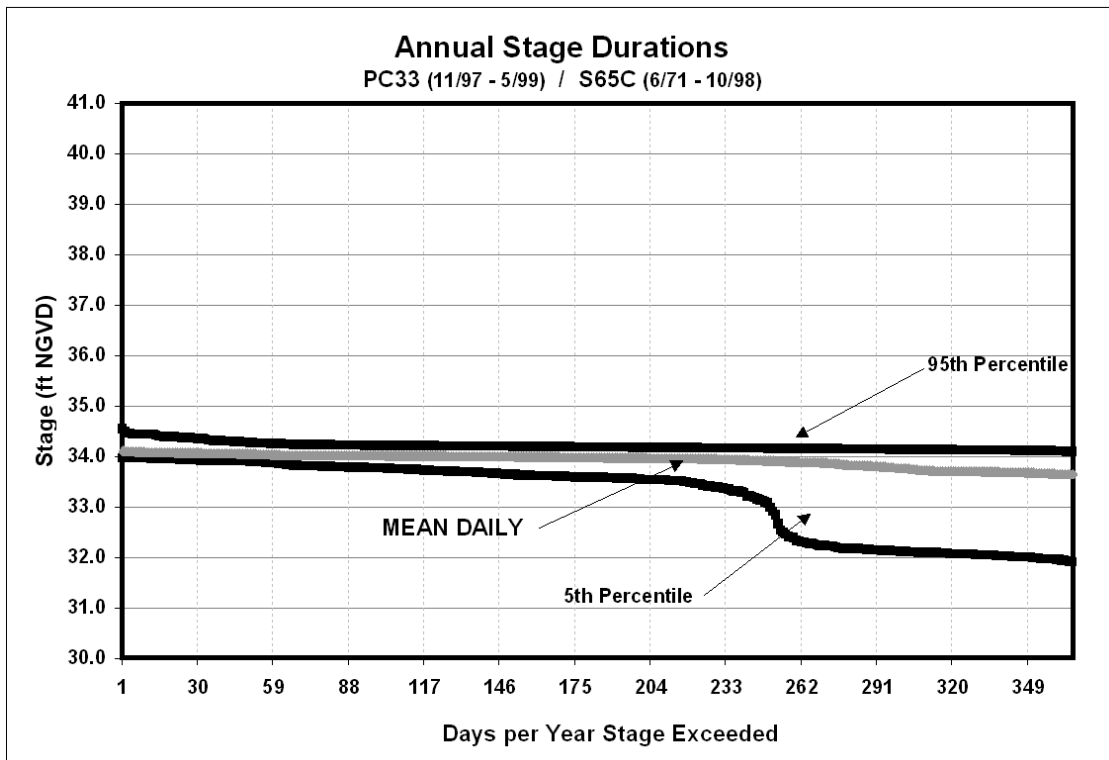Toth, L.A. 1993. The ecological basis of the Kissimmee River restoration plan. Florida Scient. 56 (1), 25-51.

Annual Stage Durations
PC33 (11/97 - 5/99) / S65C (6/71 - 10/98)

Figure 1. Pool C stage duration curves. Curves show the number of days per year that the mean-daily stage and the 95th and 5th percentiles of daily stage exceeded y-axis elevations.
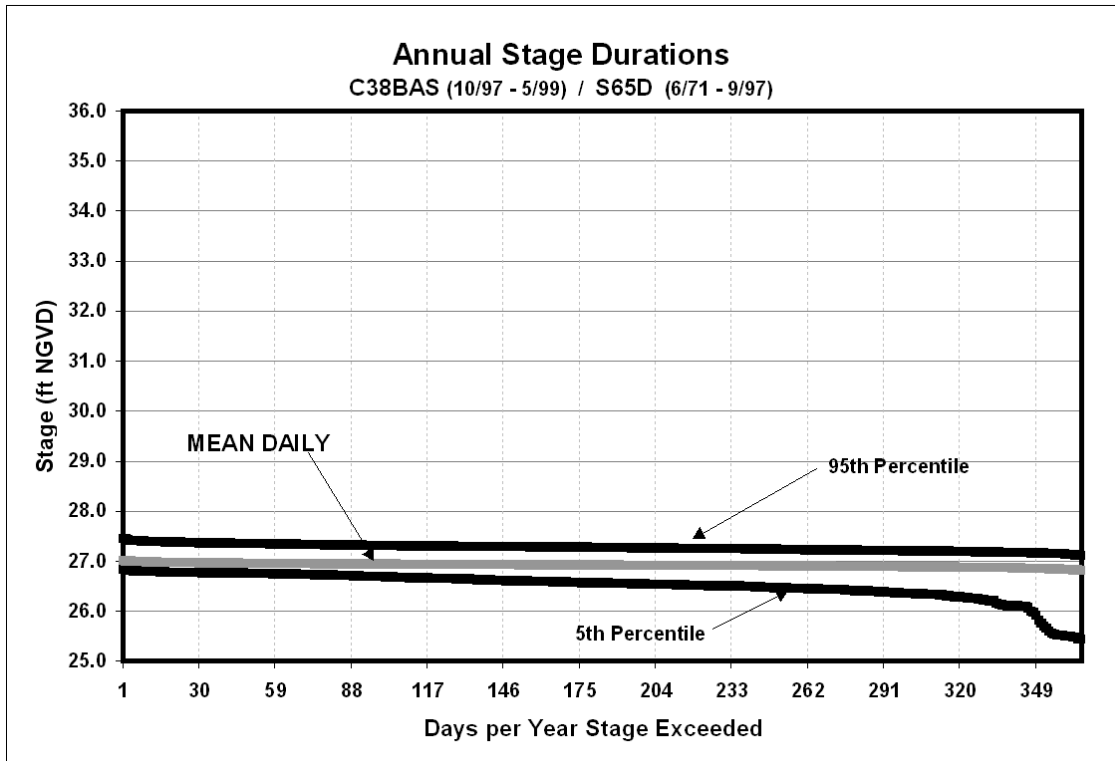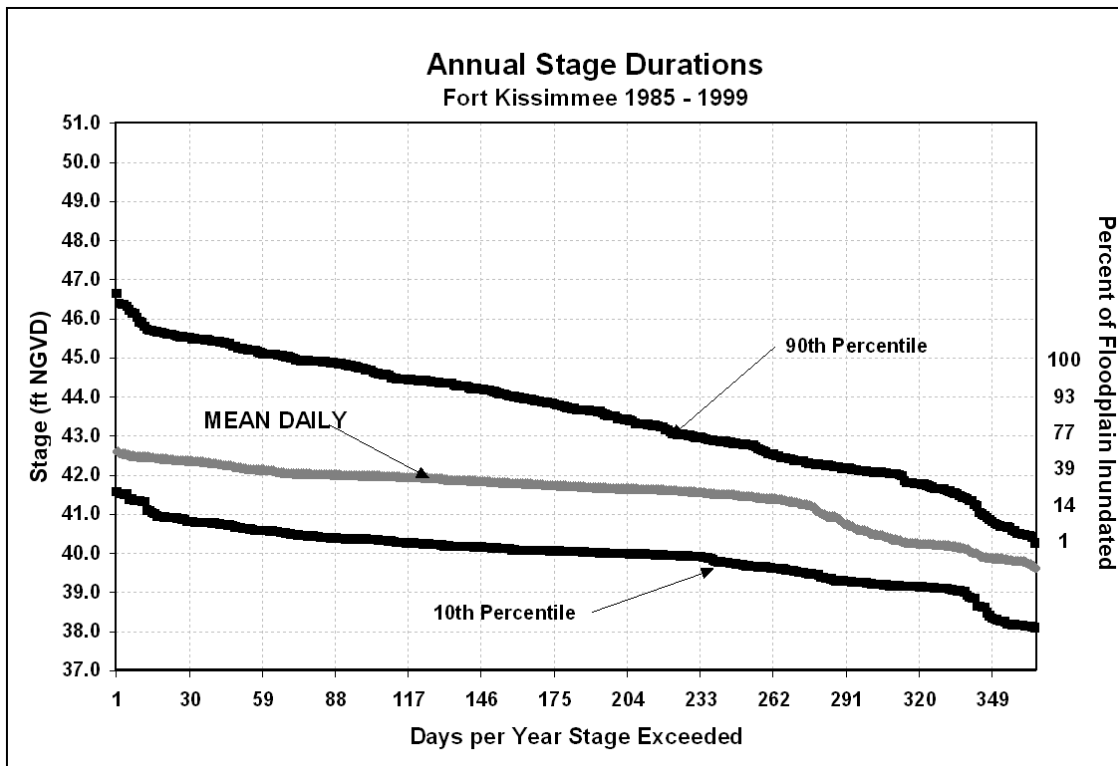

Annual Stage Durations
C38BAS (10/97 - 5/99) / S65D (6/71 - 9/97)

Figure 2. Pool D stage duration curves. Curves show the number of days per year that the mean-daily stage and the 95th and 5th percentiles of daily stage exceeded y-axis elevations.

Figure 3. Baseline stage duration curves at Fort Kissimmee. Curves show the number of days per year that the mean-daily stage and the 90th and 10th percentiles of daily stage exceeded y-axis (left) elevations. Second y-axis shows percent of floodplain that is inundated at given stages.
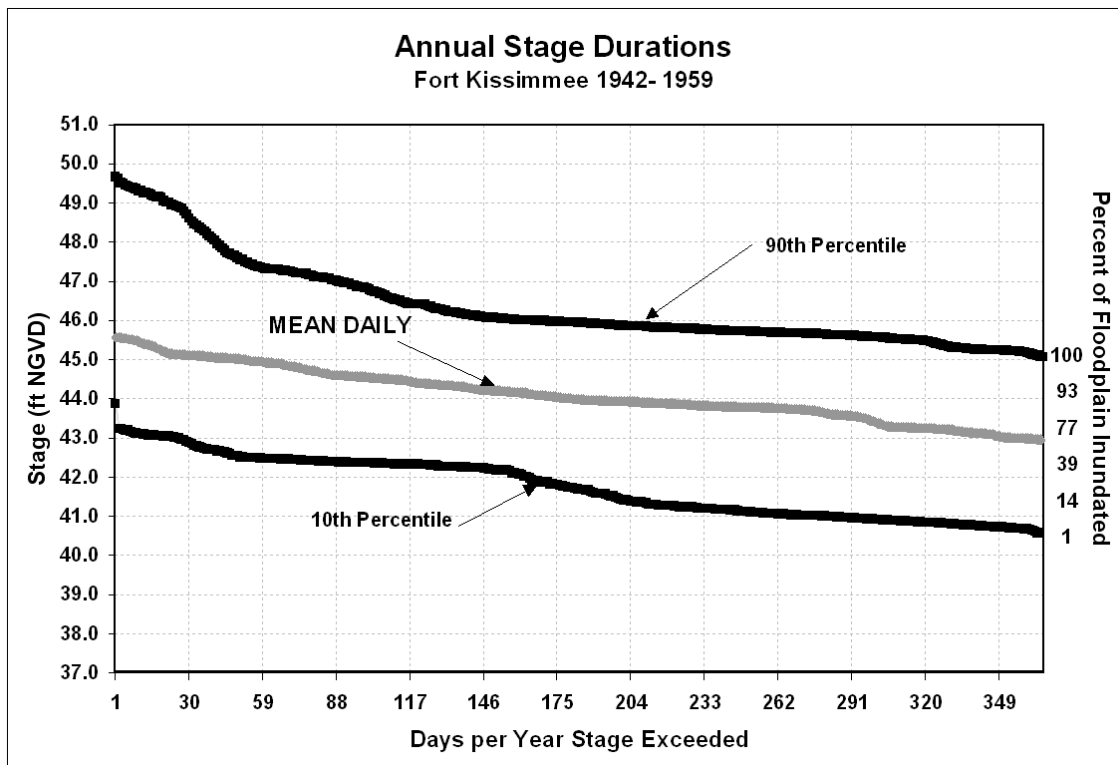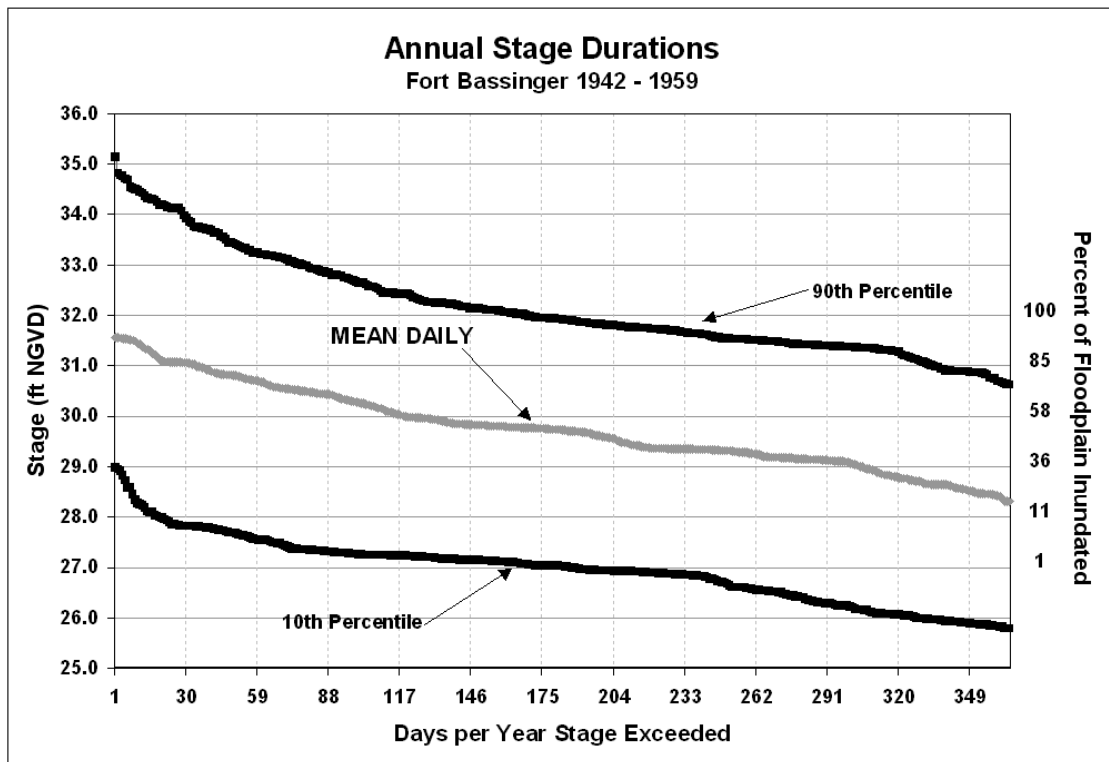

Figure 4. Stage duration curves at Fort Kissimmee prior to channelization. Curves show the number of days per year that the mean-daily stage and the 90th and 10th percentiles of daily stage exceeded y-axis (left) elevations. Second y-axis shows percent of floodplain that is inundated at given stages.
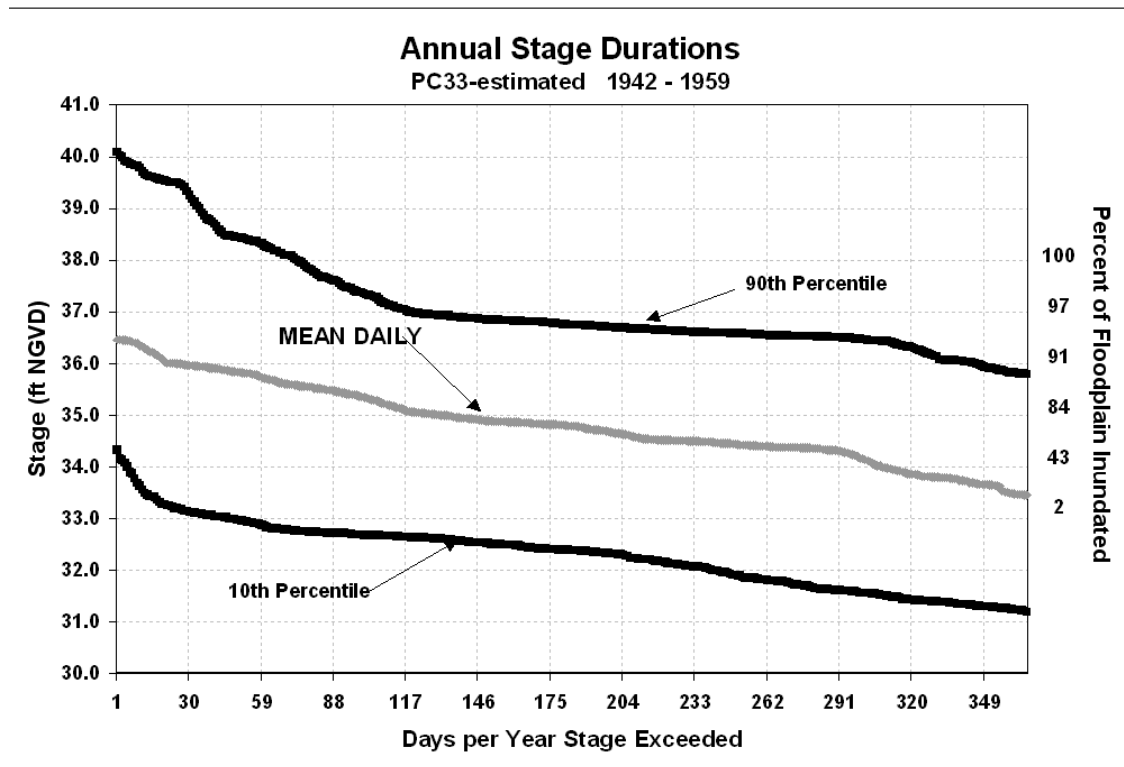
Figure 5. Stage duration curves at Fort Bassinger prior to channelization. Curves show the number of days per year that the mean-daily stage and the 90th and 10th percentiles of daily stage exceeded y-axis (left) elevations. Second y-axis shows percent of floodplain that is inundated at given stages.

Figure 6. Estimated stage duration curves at PC33 prior to channelization. Curves show the number of days per year that the mean-daily stage and the 90th and 10th percentiles of daily stage exceeded y-axis (left) elevations. Second y-axis shows percent of floodplain that is inundated at given stages.
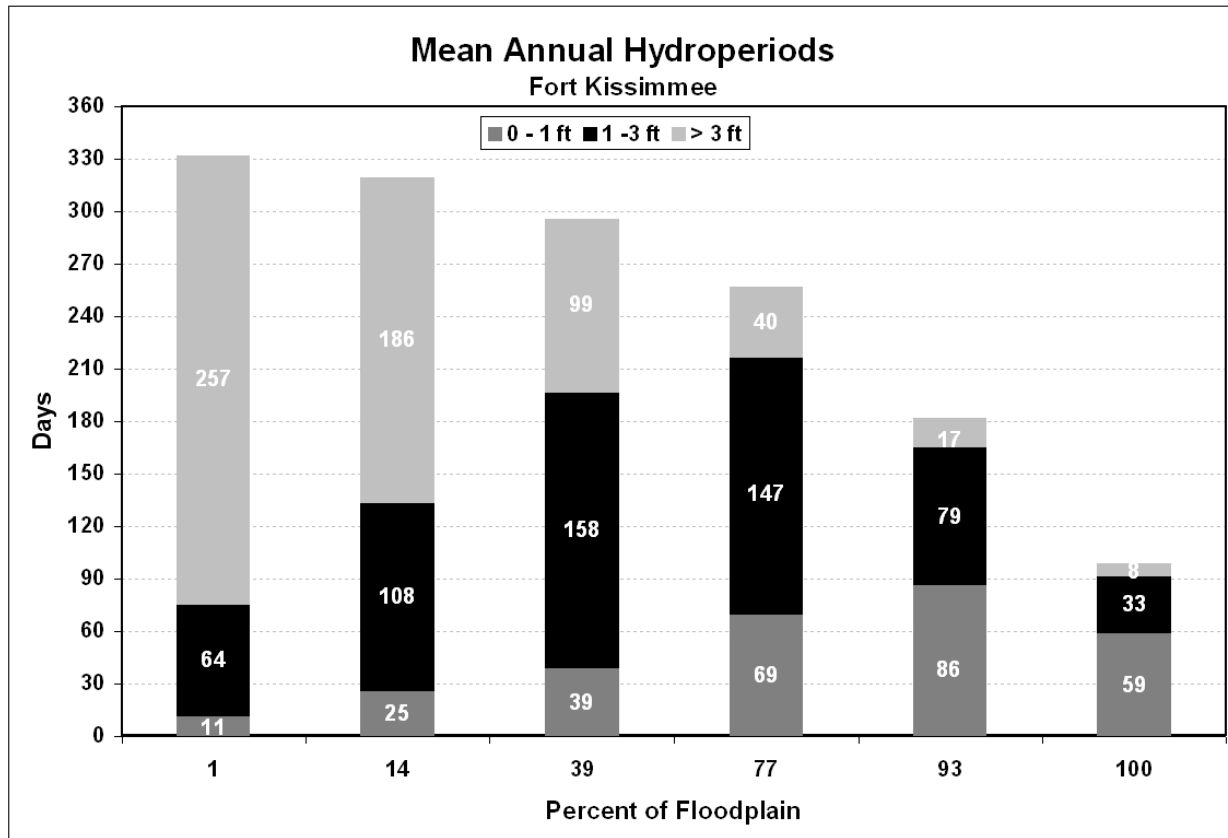
Figure 7. Average number of days per year that portions of floodplain adjacent to Fort Kissimmee were inundated at different depths. One-foot ground elevation increments (40 - 45 feet) were used to calculate the percent of floodplain inundated
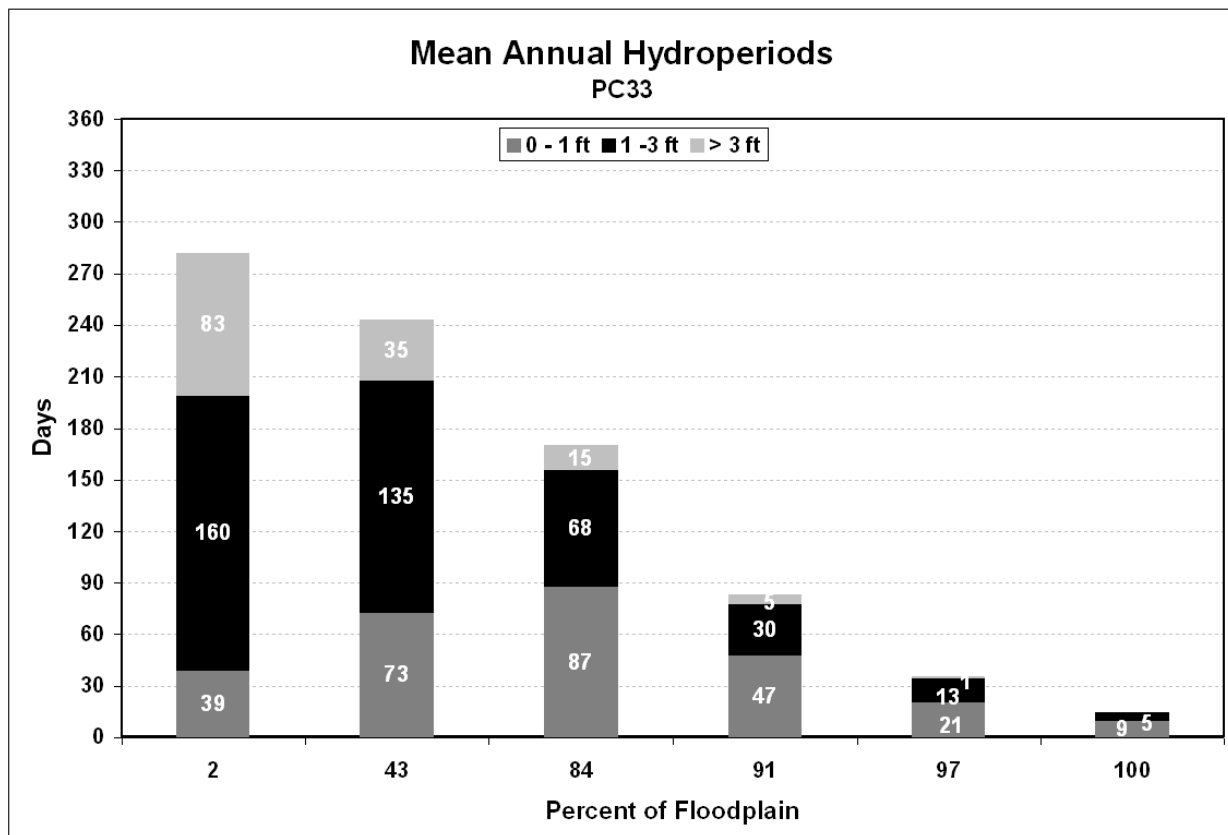

Figure 8. Estimated average number of days per year that portions of floodplain adjacent to PC33 were inundated at different depths. One-foot ground elevation increments (33 - 38 feet) were used to calculate the percent of floodplain inundated
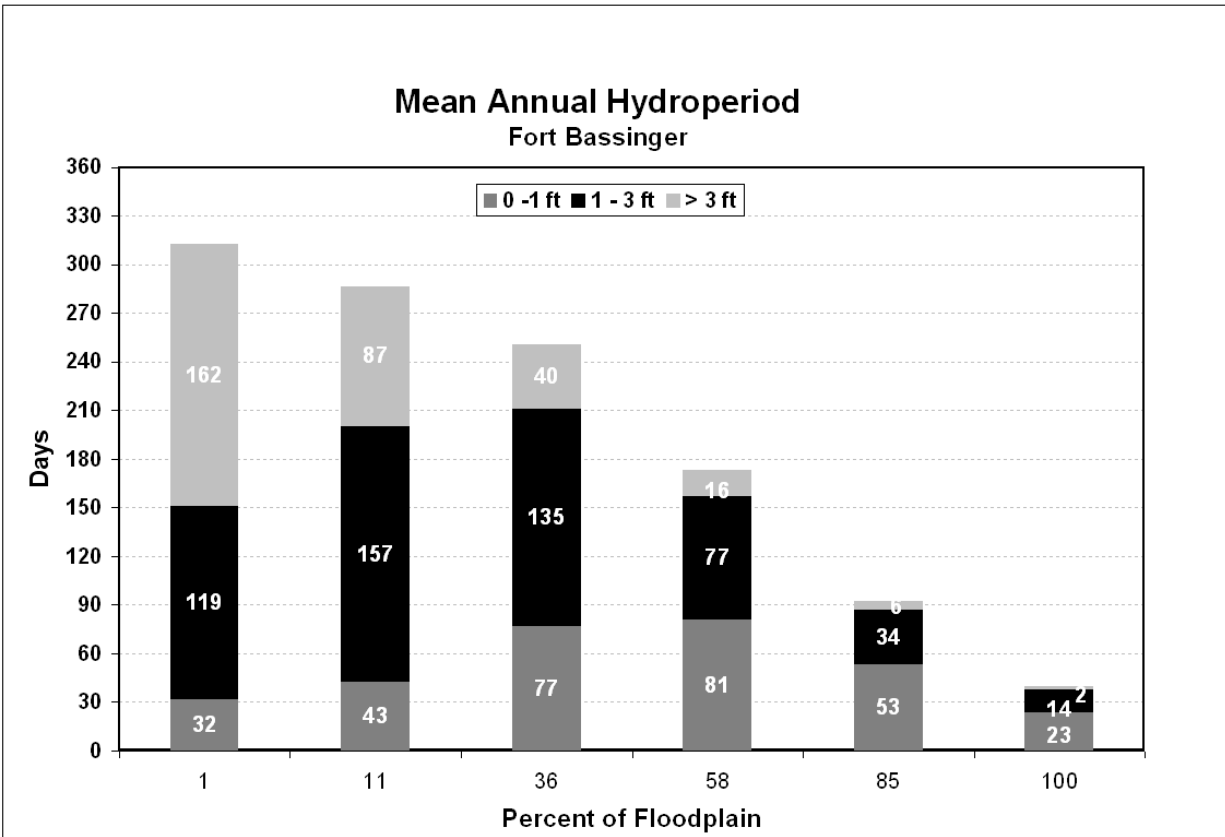
Figure 9. Average number of days per year that portions of floodplain adjacent to Fort Bassinger were inundated at different depths. One-foot ground elevation increments (27 - 32 feet) were used to calculate the percent of floodplain inundated